*Rikaline* **GPS-6031-X7**

**SiRF High sensitivity**

# Bluetooth GPS
## Receiver

**User's Guide**

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# 0. Quick Use for First Time Setting

After you have received your Rikaline GPS-6031-X7 Bluetooth GPS Receiver, please do the following steps before using the device.

## 0.1 Fully charge the battery for at least 10 hours before using.

A fully charged battery can last for 11 days (275hours) using a low power consumption scheme at 6mA standby mode. Please remove the battery if the device will not be in use for an extended period of time.

## 0.2 Activate the Bluetooth function in your PDA or PC

Before activating Bluetooth function in your PDA/PC for pairing the Receiver, please press Receiver's button for 5 seconds. The pairing code is "**1234**". Please check your device is equipped with Bluetooth function. If not, you may need to acquire an optional CF (PD-3005) or SD Bluetooth card.
***NOTE: The pairing procedure is required to execute in the first time.***

## 0.3 Automatically create a shortcut in Bluetooth Manager window

After you complete the pairing, system will automatically create a quick connect device in Bluetooth Manager. In further use, you just need to click this device to connect our Bluetooth Receiver.

## 0.4 Check the Serial Port in Bluetooth Setting

After completing pairing with the Receiver, please click "Serial Port" to confirm the COM port. If you use PDA/PC to pair the Receiver, please select "Outbound COM port"; otherwise, if you use the Receiver to pair PDA/PC, please select "Inbound COM port".

## 0.5 Set correct Serial Port in your Map software.

Activate your map function and select the correct serial port by following above **C** instruction.

## 0.6 Switch off the Bluetooth function

Switch off the Bluetooth function before you turn off your PDA/PC, and Receiver will disconnect the GPS function automatically.

## 0.7 Turn off your PDA or PC

## 0.8 Advanced Function

**GPS-6031-X7 also provides user an advanced active paring function.** Before using this advanced function, you have to click "Serial Port" in Bluetooth setting window in your PDA/PC, and then mark "Authorization required" and "Authorization passkey required". Press the Receiver's button for 1 second, then select "Accept" or "Reject" in your PDA/PC to do the linking.

**NOTE: The advanced function is not suitable for first time use.**

## 0.9 Appendix

**LED Indicator**

4 LED functions as follows (from the left side):

| | | | |
|---|---|---|---|
| 1. External Power-Red: | On: Available | Off: Not Available | |
| 2. Bluetooth-Blue: | On: Pairing / In Transmitting Mode | | |
| 3. GPS-Green: | On: GPS powered | Off: GPS not powered | |
| 4. Battery-Red: | Flash: Low Power | On: Recharging | Off: Sufficient Power |



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# 1. Introduction

## 1.1 Overview

The *Rikaline* **GPS-6031-X7 Bluetooth GPS Receiver** is a total solution GPS receiver with **Bluetooth** wireless transmitting ability, designed based on **SiRF Star II LP** (Low Power) GPS architecture, enabled with the most advanced **HS (High Sensitivity)** ability and CSR Bluetooth technology. This revolutionary system provides you unbelievable positioning sensitivity allowing you to have easy position fix in urban canyon conditions. You may use this device for strict needs of positioning applications such as car navigation, mapping, surveying, security, agriculture and so on. Only clear view of sky is necessary to the unit.

The GPS-6031-X7 communicates with other electronic utilities via wireless Bluetooth technology and saves critical satellite data by built–in backup memory. With low power consumption, the **GPS-6031-X7** tracks up to 12 satellites at a time, re-acquires satellite signals in 100 ms and updates position data every second.

## 1.2 Features

The GPS-6031-X7 provides a host of features that make it easy for integration and use.

1. Wireless transmitting positioning status up to 10 meters.
2. SiRF Star II chipset with embedded ARM7TDMI CPU available for customized applications in firmware.
3. High sensitivity receiver tracks up to 12 satellites while providing first fast fix and low power consumption.
4. Differential capability utilizes real-time RTCM corrections producing 1-5 meter position accuracy.
5. Advanced design ideal for applications with minimal space.
6. A rechargeable battery sustains GPS internal clock and memory. It is recharged during normal operation.
7. User initialization is not required.
8. Dual communication channels and user selectable baud rates allow maximum interface capability and flexibility.
9. FLASH based program memory: New software revisions upgradeable both for GPS and Bluetooth.
10. LED display status: The LED provides users visible operating status for Recharging, Battery power lever, Bluetooth and GPS. No more extra device needed.
11. Built-in WAAS / EGNOS demodulator.
12. Rechargeable Li-Polymer battery provide you a danger-Free device.

## 1.3 Technology specifications

### 1.3.1 Physical Dimension

Single construction integrated antenna/receiver.
Size: 80.1(W) x 56.8(D) x 30.3(H) (mm)
3.15"(W) x 2.24"(D) x 1.19"(H).
Weight: 87g

### 1.3.2 Environmental Characteristics

1) Operating temperature: -40°C to +85°C with external power (internal temperature).
-20°C to +60°C with internal rechargeable battery.
2) Storage temperature: -55°C to +100°C.

### 1.3.3 Electrical Characteristics

1) Input voltage: +4.75 ~ 5.5 VDC without accessories.
2) GPS Internal backup power: 3V Rechargeable Lithium cell battery, up to 767 hours (31.9 days) discharge.

### 1.3.4 Performance

#### 1.3.4.1 LED functions

We built in 4 LEDs with the GPS-6031-X7 Bluetooth GPS and function as follows:

1) External Power (Red, The left one)



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ON: Outside power available
OFF: Outside power not available

2) Bluetooth (Green, the 2nd one from left)
ON: Paring
ON: In Transmitting mode

3) GPS (Green, The 3rd one from left)
ON: GPS is powered
OFF: GPS is not powered

4) Battery (Red, The right one)
Blinking: Low Battery
OFF: Full power or still sufficient
ON: Recharging

#### 1.3.4.2 GPS Functions

1) Tracks up to 12 satellites.
2) Update rate: 1 second.
3) Acquisition time

| | |
|---|---|
| Reacquisition | 0.1 sec., averaged |
| Snap start | 3 sec., averaged |
| Hot start | 15 sec., averaged |
| Warm start | 45 sec., averaged |
| Cold start | 90 sec., averaged |

4) Position accuracy:
Non DGPS (Differential GPS)

| | |
|---|---|
| Position | 5-25 meter CEP with SA off |
| Velocity | 0.1 meters/second, with SA off |
| Time | 1 microsecond synchronized GPS time |

5) Dynamic Conditions:

| | |
|---|---|
| Altitude | 18,000 meters (60,000 feet) max |
| Velocity | 515 meters / second (1000 knots) max |
| Acceleration | 4 G, max |
| Jerk | 20 meters/second, max |

#### 1.3.4.3 Bluetooth Functions

1) Transmits up to 10 meters.
2) Details specifications please refer to appendix D at page 16.

#### 1.3.4.4 Battery

1) Capacity: 1650mAh.
2) Type: Li-Polymer rechargeable, danger-free (Non-fire, Non-explosion).

### 1.3.5 Interfaces

1) Dual channel RS-232 compatible level, with user selectable baud rate (4800-Default, 9600, 19200, 38400).
2) NMEA 0183 Version 2.2 ASCII output (GPGGA, GPGLL, GPGSA, GPGSV, GPRMC, GPVTG).
3) SiRF protocol.



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# 2. Operational characteristics

## 2.1 Initialization

Once you insert the battery into the housing, the GPS-6031-X7 is in standby mode and ready to work for you. When you activate the Bluetooth function in your machine (PDA or PC) and get pairing with PGS-6031-X7, you may start GPS function. As soon as the initial self-test is complete, the GPS-6031-X7 begins the process of satellite acquisition and tracking automatically. Under normal circumstances, it takes approximately 90 seconds to achieve a position fix at the first time, 45 seconds if ephemeris data is known. After a position fix has been calculated, information about valid position, velocity and time is transmitted over the output channel.

The GPS-6031-X7 utilizes initial data, such as last stored position, date, time and satellite orbital data, to achieve maximum acquisition performance. If significant inaccuracy exists in the initial data, or the orbital data is obsolete, it may take more time to achieve a navigation solution. The GPS-6031-X7 Auto-locate feature is capable of automatically determining a navigation solution without intervention from the host system. However, acquisition performance can be improved when the host system initializes the GPS-6031-X7 in the following situation:

1) Moving further than 1,500 kilometers.
2) Failure of data storage due to the inactive internal memory battery.

## 2.2 Navigation

After the acquisition process is complete, the GPS-6031-X7 sends valid navigation information over output channels. These data include:

1) Latitude/longitude/altitude
2) Velocity
3) Date/time
4) Error estimates
5) Satellite and receiver status

The GPS-6031-X7 sets the default of auto-searching for real-time differential corrections in RTCM SC-104 standard format, with the message types 1, 5, or 9. It accomplishes the satellite data to generate a differential (DGPS) solution. The host system, at its option, may also command the GPS-6031-X7 to output a position whenever a differential solution is available.



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# 3. Hardware interface

## 3.1 Physical

Size: 80.1(W) x 56.8(D) x 30.3(H) (mm)
3.15"(W) x 2.24"(D) x 1.19"(H).
Weight: 87g

## 3.2 Hardware Interface

The GPS-6031-X7 includes a SiRF LP (Low Power) and HS (High Sensitivity) GPS module, Bluetooth module and a Li-Polymer rechargeable battery in a unique style gadget. Simply place it on the dashboard of the car or any place facing to the sky for transmitting GPS signal to your notebook PC, PDA or other devices, which facilitated with Bluetooth functions.

## 3.3 Connector

Battery recharging connector: DC jack 2.35mm, with center "+" (positive).

## 3.4 Accessories

A-6016-235 Cigarette Adapter, 2A, with input 6-30Vdc, Dc jack 2.35mm
A-6001: recharging adapter, Universal, 120V, 230V
A-9001: Battery, Lithium-Polymer, 1650mAh

## 3.5 CONTROL BUTTON

| Button | Function | |
|---|---|---|
| KEY_ CONTROL | PIO_KC | 1. In the standby mode press the key will into connecting mode than search paired device and connecting it. Note! one paired device have 10 sec search time. If connecting success search will not go on.<br>2. In connecting mode press the key 1 sec will cancel search device.<br>3. In the standby mode press the key 5 second will into pairing mode. |

## 3.6 LED INDICATOR ABOUT CURRENT MODE

There are 3 LEDs to show the state of the SPP GPS

| # | System state | LED_BLUETOOTH | LED_GPS_POWER | LED_BATTERY |
|---|---|---|---|---|
| 1 | STANDBY | OFF | OFF | N/a |
| 2 | PAIRING | ON | OFF | N/a |
| 3 | CONNECTING | ON (300m sec)<br>OFF (300m sec) | OFF | N/a |
| 4 | ACTIVE | ON | ON | N/a |
| 5 | BATTERY FULL | N/a | N/a | OFF |
| 6 | BATTERY LOW | N/a | N/a | ON (1 SEC)<br>OFF(1 SEC) |
| 7 | BATTERY CHARGING | N/a | N/a | ON |



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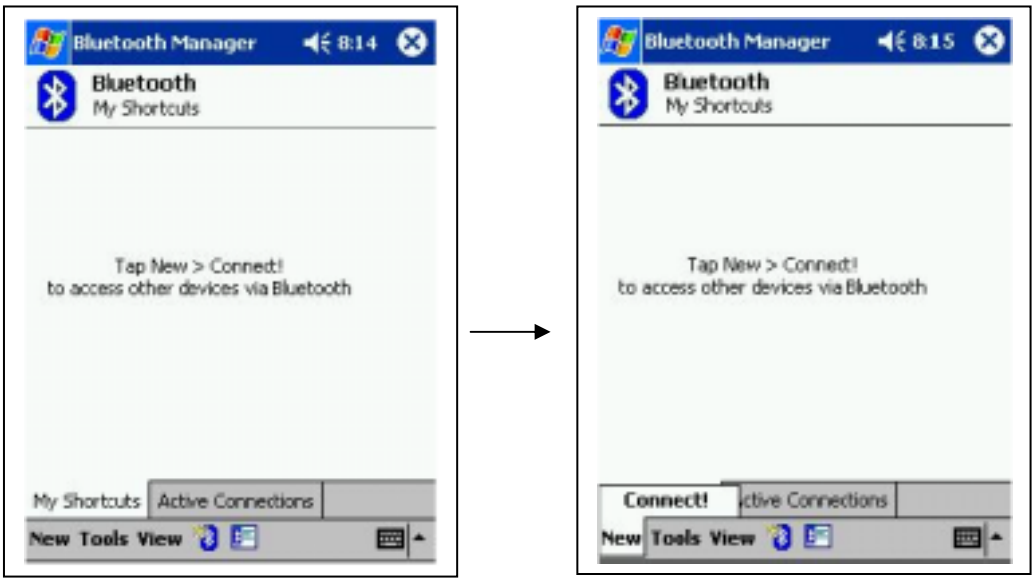
# 4. Bluetooth Connection

Please follow up below instructions step by step:

## 4.1 Browse Devices

Firstly, you should find the device with which you want to establish connection.

Open “Bluetooth Manager” on your pocket pc.
Press “New”
Press “Connect”




Search Bluetooth device “Rikaline 6031-X7”
Select “Explore a Bluetooth device”
Press “Next”

Connection Wizard 8:15
Bluetooth
Connection Wizard
Explore a Bluetooth device
Discover the services another device offers and create connection shortcuts for them.
Connect to the Internet
Access the Internet using a network access point, a cell phone or another connected Bluetooth device.
Join a personal network
Connect two or more Bluetooth devices to share files, collaborate or play multiplayer games.
Partner with a cell phone
Cancel
Next



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Found the Bluetooth device
Double click “Rikaline”

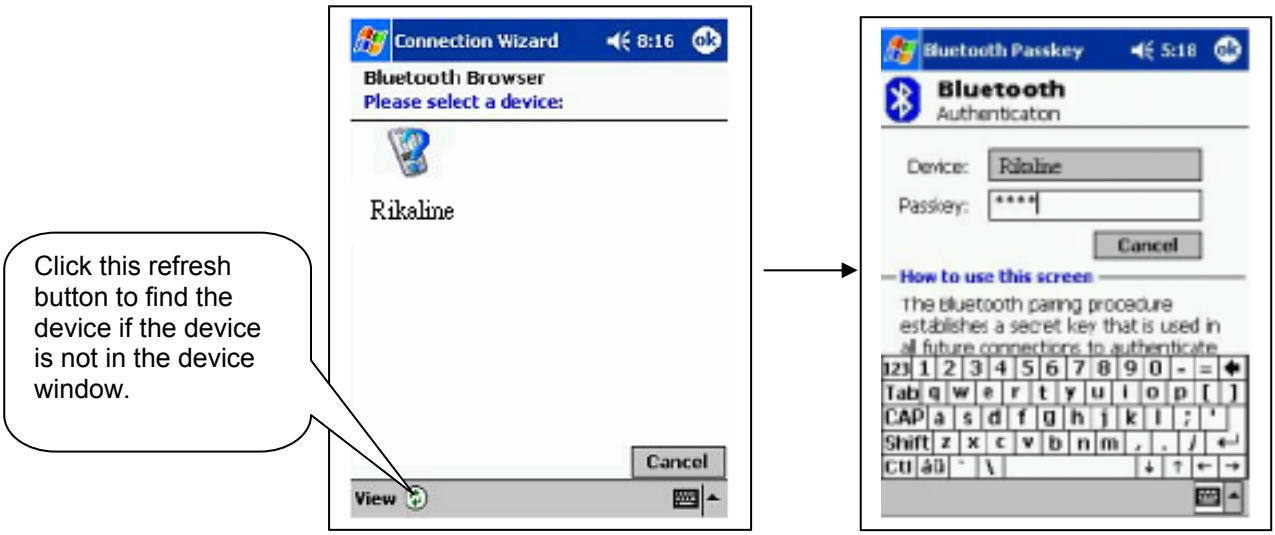


Fig. 1 Browse Service

Found the Bluetooth device and enter passkey
Tap “Rikaline”
Passkey: 1234

## 4.2 Browse Services

Double click the device with which you want to establish SPP connection to browse its service as Fig. 2.

**Connect to SPP Slave**
Select SPP slave
Press “ Next”
Press “Finish”

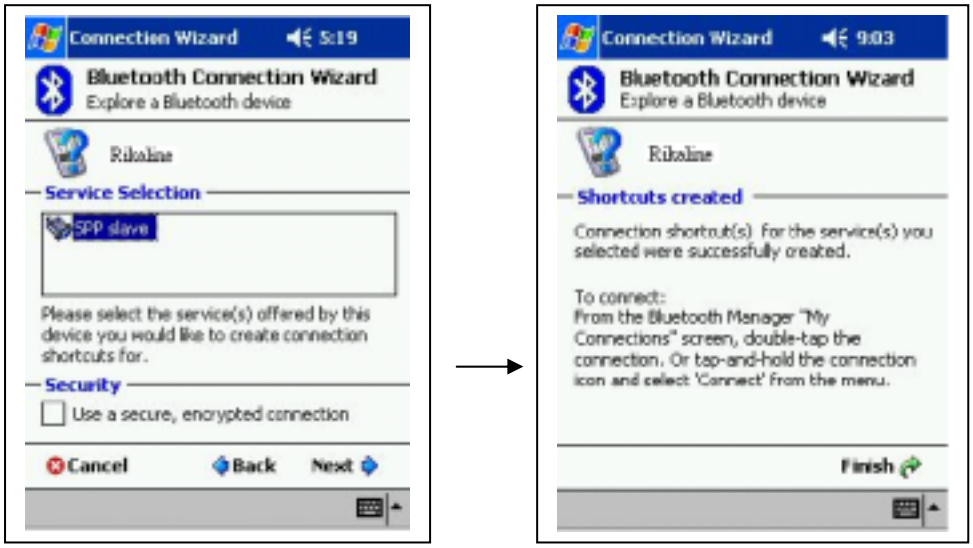


Fig. 2 Browse Service

Finish Bluetooth Manager Setup
Tap and Hold “Rikaline : SPP slave”
Press “Connect”
Finish Bluetooth setup



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After you click the SPP service, it will show at left of followings:

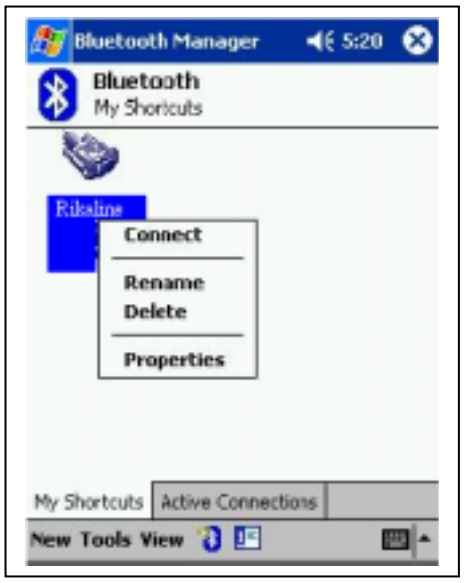


Fig. 3 Connect to SPP

Fig. 4

After connect successfully, it will show as Fig. 4

## 4.3 Application

Now you can use any Navigation system through Bluetooth SPP Profile.

## 4.4 Disconnect

There are 3 different ways to disconnect the operation

### 4.4.1 Double click the SPP shortcut, and click Disconnect on popup Menu.

Fig. 5 Disconnect from pop menu

Figure 6 Disconnect from Status Window

### 4.4.2 In the Status window, select the SPP connection, and then click Disconnect button.

In most navigation system when you select disable GPS icon, the SPP connection will be disconnected automatically. If you want to use the navigation again, you need to establish the Bluetooth SPP connection first.



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### 4.4.3 Use Shortcut

After a new connection was established successfully, a shortcut for the connection will be generated. Users also can double click the particular short cut icon (represented by the Connection Name) and click the connect on the Pop_Menu to re-establish the connection.

# 5. Warranty

The GPS-6031-X7 is warranted to be free from defects in material and functions for one year from the date of purchase. Any failure of this product within this period under normal conditions will be replaced at no charge to the customers.



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# Appendix A Software Interface

The GPS-6031-X7 interface protocol is based on the National Marine Electronics Association's NMEA0183 ASCII interface specification, which is defined in NMEA0183, Version 2.2 and the Radio Technical Commission for Maritime Services (RTCM Recommended Standards For Differential Navstar GPS Service, Version 2.1, RTCM Special Committee No.104).

## A.1 NMEA Transmitted Messages

The GPS-6031-X7 outputs data in NMEA-0183 format as defined by the National Marine Electronics Association (NMEA), Standard.

The default communication parameters for NMEA output are 4800 baud, 8 data bits, stop bit, and no parity.

**Table A-1 NMEA-0183 Output Messages**

| NMEA Sentence | Description |
|---|---|
| GPGGA | Global positioning system fixed data |
| GPGLL | Geographic position latitude \ longitude |
| GPGSA | GNSS DOP and active satellites |
| GPGSV | GNSS satellites in view. |
| GPRMC | Recommended minimum specific GNSS data |
| GPVTG | Course over ground and ground speed |

### A.1.1 Global Positioning System Fix Data (GGA)

Table A-2 contains the values for the following example:

**$GPGGA,161229.487,3723.2475,N,12158.3416,W,1,07,1.0,9.0,M, , , ,0000*18**

**Table A-2 GGA Data Format**

| Name | Example | Units | Description |
|---|---|---|---|
| Message ID | $GPGGA | | GGA protocol header |
| UTC Time | 161229.487 | | Hhmmss.sss |
| Latitude | 3723.2475 | | ddmm.mmmm |
| N/S Indicator | N | | N=north or S=south |
| Longitude | 12158.3416 | | dddmm.mmmm |
| E/W Indicator | W | | E=east or W=west |
| Position Fix Indicator | 1 | | See Table 5-3 |
| Satellites Used | 07 | | Range 0 to 12 |
| HDOP | 1.0 | | Horizontal Dilution of Precision |
| MSL Altitude | 9.0 | Meters | |
| Units | M | Meters | |
| Geoid Separation | | Meters | |
| Units | M | Meters | |
| Age of Diff. Corr. | | Second | Null fields when DGPS is not used |
| Diff. Ref. Station ID | 0000 | | |
| Checksum | *18 | | |
| <CR> <LF> | | | End of message termination |

**Table A-3 Position Fix Indicator**

| Value | Description |
|---|---|
| 0 | 0 Fix not available or invalid |
| 1 | GPS SPS Mode, fix valid |
| 2 | Differential GPS, SPS Mode, fix valid |
| 3 | GPS PPS Mode, fix valid |



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### A.1.2 Geographic Position with Latitude/Longitude (GLL)

Table A-4 contains the values for the following example:

**$GPGLL,3723.2475,N,12158.3416,W,161229.487,A*2C**

**Table A-4 GLL Data Format**

| Name | Example | Units | Description |
|---|---|---|---|
| Message ID | $GPGLL | | GLL protocol header |
| Latitude | 3723.2475 | | ddmm.mmmm |
| N/S Indicator | N | | N=north or S=south |
| Longitude | 12158.3416 | | dddmm.mmmm |
| E/W Indicator | W | | E=east or W=west |
| UTC Position | 161229.487 | | hhmmss.sss |
| Status | A | | A=data valid or V=data not valid |
| Checksum | *2C | | |
| <CR> <LF> | | | End of message termination |

### A.1.3 GNSS DOP and Active Satellites (GSA)

Table A-5 contains the values for the following example:

**$GPGSA,A,3,07,02,26,27,09,04,15, , , , , ,1.8,1.0,1.5*33**

**Table A-5 GSA Data Format**

| Name | Example | Units | Description |
|---|---|---|---|
| Message ID | $GPGSA | | GSA protocol header |
| Mode 1 | A | | See Table 5-6 |
| Mode 2 | 3 | | See Table 5-7 |
| Satellite Used (1) | 07 | | Sv on Channel 1 |
| Satellite Used (1) | 02 | | Sv on Channel 2 |
| …… | | | …. |
| Satellite Used | | | Sv on Channel 12 |
| PDOP | 1.8 | | Position Dilution of Precision |
| HDOP | 1.0 | | Horizontal Dilution of Precision |
| VDOP | 1.5 | | Vertical Dilution of Precision |
| Checksum | *33 | | |
| <CR> <LF> | | | End of message termination |

(1) Satellite used in solution.

**Table A-6 Mode 1**

| Value | Description |
|---|---|
| M | Manual—forced to operate in 2D or 3D mode |
| A | 2D Automatic—allowed to automatically switch 2D/3D |

**Table A-7 Mode 2**

| Value | Description |
|---|---|
| 1 | Fix Not Available |
| 2 | 2D |
| 3 | 3D |

### A.1.4 GNSS Satellites in View (GSV)

Table A-8 contains the values for the following example:

**$GPGSV,2,1,07,07,79,048,42,02,51,062,43,26,36,256,42,27,27,138,42*71**
**$GPGSV,2,2,07,09,23,313,42,04,19,159,41,15,12,041,42*41**



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**Table A-8 GSV Data Format**

| Name | Example | Units | Description |
|---|---|---|---|
| Message ID | $GPGSV | | GSV protocol header |
| Number of Messages | 2 | | Range 1 to 3 |
| Message Number | 1 | | Range 1 to 3 |
| Satellites in View | 07 | | Range 1 to 12 |
| Satellite ID | 07 | | Channel 1 (Range 1 to 32) |
| Elevation | 79 | degrees | Channel 1 (Maximum 90) |
| Azimuth | 048 | degrees | Channel 1 (True, Range 0 to 359) |
| SNR (C/No) | 42 | dBHz | Range 0 to 99, null when not tracking |
| .... | .... | | |
| Satellite ID | 27 | | Channel 4 (Range 1 to 32) |
| Elevation | 27 | degrees | Channel 4 (Maximum 90) |
| Azimuth | 138 | degrees | Channel 4 (True, Range 0 to 359) |
| SNR (C/No) | 42 | dBHz | Range 0 to 99, null when not tracking |
| Checksum | *71 | | |
| <CR> <LF> | | | End of message termination |

**NOTE:** Items <4>,<5>,<6> and <7> repeat for each satellite in view to a maximum of four (4) satellites per sentence. Additional satellites in view information must be sent in subsequent sentences. These fields will be null if unused.

## A.1.5 Recommended Minimum Specific GNSS Data (RMC)

Table A-9 contains the values for the following example:

**$GPRMC,161229.487,A,3723.2475,N,12158.3416,W,0.13,309.62,120598, ,*10**

**Table A-9 RMC Data Format**

| Name | Example | Units | Description |
|---|---|---|---|
| Message ID | $GPRMC | | RMC protocol header |
| UTC Time | 161229.487 | | hhmmss.sss |
| Status | A | | A=data valid or V=data not valid |
| Latitude | 3723.2475 | | ddmm.mmmm |
| N/S Indicator | N | | N=north or S=south |
| Longitude | 12158.3416 | | dddmm.mmmm |
| E/W Indicator | W | | E=east or W=west |
| Speed Over Ground | 0.13 | Knots | |
| Course Over Ground | 309.62 | Degrees | True |
| Date | 120598 | | ddmmyy |
| Magnetic Variation (1) | | Degrees | E=east or W=west |
| Checksum | *10 | | |
| <CR> <LF> | | | End of message termination |

(1) SiRF Technology Inc. does not support magnetic declination. All “course over ground” data are geodetic WGS84 directions.

## A.1.6 Course Over Ground and Ground Speed

Table A-10 contains the values for the following example:

**$GPVTG,309.62,T, ,M,0.13,N,0.2,K*6E**

**Table A-10 VTG Data Format**

| Name | Example | Units | Description |
|---|---|---|---|
| Message ID | $GPVTG | | VTG protocol header |
| Course | 309.62 | Degrees | Measured heading |
| Reference | T | | True |
| Course | | Degrees | Measured heading |



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| | | | |
|---|---|---|---|
| Reference | M | | Magnetic (1) |
| Speed | 0.13 | Knots | Measured horizontal speed |
| Units | N | | Knots |
| Speed | 0.2 | Km/hr | Measured horizontal speed |
| Units | K | | Kilometers per hour |
| Checksum | *6E | | |
| <CR> <LF> | | | End of message termination |

(1) SiRF Technology Inc. does not support magnetic declination. All “course over ground” data are geodetic WGS84 directions.

## A.2 RTCM Received Data

The default communication parameters for DGPS Input are 9600 baud, 8 data bits, stop bit, and no parity. Position accuracy of less than 5 meters can be achieved with the GPS-6031-X7 by using Differential GPS (DGPS) real-time pseudo-range correction data in RTCM SC-104 format, with message types 1, 5, or 9. As using DGPS receiver with different communication parameters, GPS-6031-X7 may decode the data correctly to generate accurate messages and save them in battery-back SRAM for later computing.



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# Appendix B Earth Datums & Output Setting

## B.1 Earth Datums

The GPS-6031-X7 is built in earth datum with WGS84.

## B.2 Setting

### B.2.1 Manufacturing Default

Datum: WGS84.
Baud Rate: 4800.
Output: GGA, GSA, GSV, RMC, VTG.
WAAS OFF



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# Appendix C Bluetooth Specifications

## C.1 Specifications

### C.1.1 Major Specification

| | Specifications |
|---|---|
| Wireless Interface | Compliant with Bluetooth Spec. Version 1.1 |
| Bluetooth Protocol Stack Supported | L2CAP, RFCOMM, SDP |
| Bluetooth Profiles Supported | SPP |
| Frequency | 2.4 GHz license-free ISM band |
| Range (Open Environment) | Up to 10 meters Range (30ft) |
| Radio Receiver Sensitivity | <-84dBm at 1 e-3 BER |
| Compatibility | ---- |

### C.1.2 UART

The UART interface uses the parameters: 4800-8-N-1 and no flow control.

## C.2 LED status specification

| NO. | Function | Description |
|---|---|---|
| 1 | P1 | ON: Recharging<br>Blinking: Battery Low |
| 2 | P2 | On: Vin (Recharging) Available.<br>OFF: Vin (Recharging) Not available |
| 3 | BT | ON: Data Transmitting<br>OFF: Standby<br>ON.: Pairing |
| 4 | GPS | ON: Powered<br>OFF: Not Powered |

## C.3 Switch

| NO. | Function | Description |
|---|---|---|
| 1 | SW-1 | For paring and link of Bluetooth. |
| | | |



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# Appendix D Battery Specifications

## D.1 Specifications

### D.1.1 General Specification

| | ITEM | SPECIFICATION |
|---|---|---|
| 1 | Type | Lithium-Polymer Rechargeable Battery |
| 2 | Model | A-9001 |
| 3 | Typical Capacity<br>Minimum Capacity | 1650 mAh<br>1500 mAh |
| 4 | Nominal Voltage | 3.7 V |
| 5 | Internal Resistance (packed) | ≤ 80mΩ |
| 6 | Weight | Approx 12 g |
| 7 | Maximum Charge Current | 1.0 C (1650 mA) |
| 8 | Charge Voltage | 4.20 ± 0.05 V |
| 9 | Maximum Discharge Current | 2.0 C (3300 mA) |
| 10 | End of Discharge Voltage | 2.8V by pcb protection, cell can be 2.6V |
| 11 | Temperature<br>For Recharge<br>For Discharge | <br>0 ~ 45 °C<br>-20 ~ +60 °C |
| 12 | Storage Temperature<br>Within 1 month<br>Within 6 months | <br>-20~+45 °C*<br>-20~+35 °C* |

### D.1.2 Testing Data

| | ITEM | MEASURING PROCEDURE | CRITERIA |
|---|---|---|---|
| 1 | Appearance /dimensions | Visual and calipers | No defect or leakage. Dimension refers to drawing. |
| 2 | Open circuit voltage | Within 1 hour after charge as 1C, 4.2V, measure open circuit voltage. | ≥ 4.15 V |
| 3 | Discharge capacity(1.0C) | Within 1 hour after charge as 1C, 4.2V, discharge until end of discharge voltage at 1C, measure the capacity. | Capacity ≥ 1650 mAh |
| 4 | Cycle life | Recharge: as 1C, 4.2V<br>Discharge:1C to 3.0 V at 25±3 ºC<br>This charge-discharge cycle shall be repeated 400 times and the discharge capacity≥ 80% of the minimum capacity. | Capacity ≥ 1320mAh |
| | Self-discharge | After recharge as 1C, 4.2V, store the testing cells at 25±3 ºC for 28 days. Then discharge at 0.2 C to 3.0 V, the capacity≥ 85% of minimum capacity. | Capacity≥ 1402mAh |
| | High-Temperature Charge retention | After recharge as 1C, 4.2V, store the testing cells at 60±3 ºC for 4 hours. Then discharge at 1.0 C to 3.0 V, the capacity≥ 90% of minimum capacity. | capacity ≥ 1485 mAh |
| 8 | Low-Temperature Charge retention | After charge as 1C, 4.2V, store the testing cells at -20±3 ºC for 4 hours. Then discharge at 0.2 C to 3.0 V, the capacity≥ 70% of minimum capacity. | capacity ≥ 1155 mAh |
| 9 | Leakage checking | After charge as 1C, 4.2V, store the testing cells at -20±3 ºC zone for 1 hour then transfer into 60±3 ºC zone for 1 hour. Repeat this 2- hour cycle 32 times for a total of 64 hours. | Weight lost＜40 mg |
| 10 | Drop test | Drop the cells from 1.5 m above a concrete floor for 18 times (3 times per face, 6 faces per cell), measure the AC | AC impedance increase |



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| | | | |
|---|---|---|---|
| | | impedance. | ≤ 100% |
| 11 | Over-Recharging | After recharge as per 1C, 4.2V, connect the cell to a power supply with constant current-constant voltage function. Adjust current to 3A and max voltage to 4.6V. Then recharging with 3A until voltage reaches 4.6V, current decreases to almost 0 A. Stop the test when battery temperature decreases by 10 ºC from the maximum. | No fire, no explosion |
| 12 | Hot box test | Preheat the oven to 150℃, place the cell with an attached thermal couple in the oven, monitor the temperature of the cell, keep for 10 minutes after the cell temperature reaches 150℃. | No fire, no explosion |
| 13 | Nail test | A stainless steel nail having a diameter of 3mm shall be punched through the cell until the nail has passed through the opposite side of the cell. | No explosion |

## D.2 Cautions

1) The best operating performance is between -20 ~ +60 °C. Higher or lower temperature could cause damage to the battery.

2) Operated with external power supply will not hurt battery life since battery does not discharge. Therefore, it operating temperature range is -40 ~ +85 °C

3) Recharge the battery for 10 hours before use.



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# Appendix E Trouble Shooting

## E.1 Trouble Shooting

| Problems | Reasons | Methods |
|---|---|---|
| No position output but timer is counting | Weak or no GPS signal can be received at the place of 6031-X7 | Find a a open space to your 6031-X7 |
| No position output but timer is counting | At outdoor space but GPS signal is blocked by building or car roof. | Go outdoor and run Application software |
| Execute fail | Bluetooth function unstable | Re-Start PDA or PC and re-install software |
| Can not turn on the COM port | Install 6031-X7 incompletely or The COM port of the device is being used | Install 6031-X7 completely or stop other device that is being used. |
| Can not find out 6031-X7 | Poor connection | Re-Start PDA or PC and re-install software. |
| No Signal | No action for few minutes may cause Pocket PC entry power save mode. It will close the COM port at the same time. | Close the application and execute it again to reopen the COM port. |
| No Signal | Weak or no GPS signal when using 6031-X7 indoor | Go outdoor to improve the poor GPS signal. |



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# Appendix F Ordering Information

## F.1 Product Options

### F.1.1 Standard Package

GPS-6031-X7 (Bluetooth GPS Receiver) + Battery + Home Charger + Cigarette Adapter + CD + Warranty Card + Quick Installation Reference + 2 Sets of Wings. For series no. **after 64003000.**

### F.1.2 Color Option

Dark Grey Base + Color Wings (Standard)
White Base + Color Wings (Optional)

## F.2 Accessories

### F.2.1 Power Adapter

A-6017-235 Cigarette Adapter, 2A, with input 6-30Vdc, Dc jack 2.35mm
A-6001: Recharging Adapter, Universal, 120V, 230V

### F.2.2 Battery

A-9001: Battery, Lithium-Polymer, 1650mAh

### F.2.3 PDA Holder

| | | |
|---|---|---|
| 1 | A-2001-A | PDA Holder, Suction Cup, 150mm, Short Arm |
| 2 | A-2001-AL | PDA Holder, Suction Cup, 150-320mm Adjustable |
| 3 | A-2002-A | PDA Holder, Suction Cup, 150mm, Short Arm, Magnetic Pad |
| 4 | A-2002-AL | PDA Holder, Suction Cup, 320mm, Long Arm, Magnetic Pad |
| 5 | A-2005-A | PDA Holder, Suction Cup, 150mm, Short Arm, 4-Claw |
| 6 | A-2005-AL | PDA Holder, Suction Cup, 320mm Long Arm, 4-Claw |
| 7 | A-2006-A | PDA Holder, Suction Cup, 150mm Short Arm, 3-Claw |
| 8 | A-2006-AL | PDA Holder, Suction Cup, 150mm Long Arm, 3-Claw |
| 9 | A-2007 | PDA Holder, Suction Cup, 150mm Short Straight Arm, 4-Claw |
| 10 | A-2008 | PDA Holder, Suction Cup, 150mm Short Straight Arm, 3-Claw |



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